REMARKS/ARGUMENTS

Rejection under 35 U.S.C. 103(a)

The Examiner rejected claims 1 to 11 as being unpatentable over Davitt et al. (US 4419154) in view of Taylor et al. (US 3291664).

Enclosed is a Declaration from the inventor, Rejean Aube, explaining the meaning and significance that Davitt et al. and Taylor et al. would have to a skilled artisan. The comments in the Declaration make it clear that the fact that red lead has no material influence on the burn rate in amounts up to 15wt% was not obvious or predictable from Davitt et al, and also the fact that the red lead, when present in such amounts, can stabilize the ignition and propagation of the delay composition in rigid metal confinement elements was also not obvious or predictable from Davitt et al. The discovery of these unexpected facts by the inventor means that red lead can be used in amounts large enough to overcome difficulties in producing homogenous mixtures for use in rigid metal elements, but without affecting the desired burn rates of the compositions.

Additionally, the following comments are provided below.

The Examiner stated:

> *Davitt discloses that increasing the amount of red lead increases the burn rate and conversely that lesser amounts of red lead would lower the burn rate. The fact that the Examiner has a different reason for obviousness is irrelevant.*

It seems that the Examiner is saying that, since Davitt et al. discloses the concept of using red lead to increase the burn rate, it would be obvious to use any amount of red lead, merely chosen according to the burn rate required for particular applications. Consequently, according to this logic, it would be obvious to use amounts of red lead falling within the range claimed in the present application, i.e. amounts of 3 to 15% by weight. The fact that applicant has found unexpected advantages for this range of red lead content is, according to the Examiner, irrelevant because a person of skill in the art would find it obvious to produce such compositions for burn rate modification even without a realization of the unexpected finding of the present invention.

This reasoning assumes that Davitt et al. teaches a near linear effect of red lead content on burn rate, i.e. that a small amount produces a small increase in burn rate, and a large amount produces a large increase in burn rate. However, the teaching of Davitt et al. is not as clear as the Examiner implies. Firstly, the general statements in Davitt et al. regarding the use of red lead are rather tentative, e.g. at column 5, line 46 to column 6, line 4 it is stated that:

> *The barium sulphate/silicon delay composition of the present invention may in some cases, advantageously contain a proportion of red lead oxide. The inclusion of red lead oxide has the effect of somewhat speeding up the burning time of the composition without any adverse effect on either toxicity or water solubility.* (emphasis added)

This is not a clear statement that red lead oxide speeds up the burning time in all cases, nor that its effect is pronounced or predictable. A skilled artisan, upon reading this statement, would not assume that red lead has predictable effects and would understand that further experimentation would be required beyond the information and testing reported in the reference itself, particularly when contemplating a composition for use in rigid metal confinement elements since Davitt et al. is limited to the use of such elements made of lead (col. 2, lines 65 and 66; and col. 6, line 38).

Davitt et al. mentions only red lead contents in the range of 25 to 75% by weight and describes these amounts as "typical" (col. 6, line 4). A skilled artisan would therefore understand that amounts above and below this range are not typical, and would therefore be discouraged from using them. This teaching is also inconsistent with the concept of a "linear relationship" but instead suggests the usefulness of only a specific amount or range or red lead addition.

This implication is reinforced by the information provided in Examples 13 to 33 of Davitt et al. which show a complex relationship between silicon as a fuel and red lead as an oxidant, as discussed below.

In Examples 13 to 19, the ratio of barium sulfate to red lead is kept constant (at 0.80), and the proportion of silicon is varied. A significant variation of mean delay time is shown in Table VII, but the inference could reasonably be taken that this is due to the variation in amounts of silicon and not necessarily (or only) the variation in red lead. The proportion of silicon varies

from 5.7 to 35% by weight, whereas the proportion of red lead varies from 52.4 to 36.1% – a much smaller variation.

In Examples 20 to 27, the proportion of silicon is kept constant (at 6.7% by weight) and the proportions of barium sulfate and red lead are varied. The variation of red lead is from 49.1% to 74.1%, and the variation of barium sulfate is from 44.2 to 19.2% as shown in Table VIII. Again there is a significant effect on mean delay time, but it is difficult to say if this is due to the variation of the amount of barium sulfate or the amount of red lead, or both. It is to be noted that a mixture containing no barium sulfate was used as a control, implying that the effect of variations of barium sulfate were under consideration in the Example. It is also stated (at col. 7, lines 32 to 37) that:

> *... in the case of ... compositions in which the proportion of silicon is fixed, any increase in the proportion of barium sulphate (at the expense of red lead oxide) has the effect of retarding the delay time of the composition.*

This strongly implies that any variation is due to an interplay between proportions of barium sulfate and red lead, rather than to variations of red lead itself. That is to say, in order to achieve variations in the burn rate, red lead must displace amounts of barium sulfate (or *vice versa*) while keeping the proportion of Si constant.

In Example 28, the effect of the specific surface area of silicon is under review and the percentage of red lead is kept constant at 49.1%. It is to be noted that a considerable variation of the mean delay time is obtained as shown in Table IX due to the variations of the surface area of the silicon, so it is certainly not true that it is only variations in red lead content that produce variations of the mean delay time.

Examples 29 and 30 investigate the relationship between mean delay time and element length for two specific combinations containing, respectively, 64.1 and 51.8% red lead. The results show a linear relationship between burn time and length. While the delay times are shorter for the higher content of red lead (as shown in Table X), this merely confirms results for two specific compositions that differ significantly from those required by the present invention.

Examples 31 and 32 assess the low temperature performance and reliability of two compositions that are the same of those of Examples 29 and 30. Again, shorter delay times are obtained for the composition with a higher content of red lead (as shown in Table XI), but again just for the same two compositions as discussed above.

Example 33 merely tests the results of a single composition (containing 64.1% red lead – the same composition as Examples 29 and 31) for use in electric detonators.

It is of note that there is no Example that compares delay timings of compositions in which the ratio of barium sulfate to silicon is kept constant and the percentage of red lead is varied. Such an Example would perhaps have been a more reliable indicator of the effect of red lead on mean delay timings and burn rates.

The sum effect of these Examples is that variations of burn rate can be achieved, but such variations may be due to a combination of features and not just the amount of red lead added to compositions of barium sulfate and silicon of fixed proportions. Also, there is no clear proof that variations of burn rate are predictably proportional to the amounts of red lead in the compositions, nor that the accelerant effect of red lead is demonstrated at contents less than 36.1% by weight (Example 19 – the example using the lowest amount of red lead).

Hence, the teaching of Davitt et al. is not clear regarding the effect of red lead and no linear relationship has been demonstrated or claimed. There is also no suggestion that the use of amounts of red lead less than 25wt% is useful for any purpose whatsoever.

Consequently, a skilled artisan would not be able to make any reliable conclusions about the effects of amounts of red lead less than 25% on burn rates of the compositions based on the information in Davitt et al. and would have to carry out further experimentation before reaching any conclusions. After all, logic would dictate that at least the proportion of silicon (as the fuel) must also affect the burn rate, and that there must come a point at which additions of small amounts of red lead produce no significant variation of burn rate because their contributions are not significant. This latter point is borne out by the mention in Davitt et al. of the lower limit of 25wt%. This is in fact confirmed by the tests disclosed in the present application. The test results shown in Table 1 (page 12, lines 1-11) and Figs. 9 and 10 of the present application show that, at contents from 3% up to 9%, red lead quite

unexpectedly increases the average time of delay compared to a composition having 0% red lead (hence the red lead is not acting as an accelerant in the combustion reaction). It is only at contents above about 15% that the reduction of delay time starts to become significant (Fig. 9). Consequently, not only would a person of skill in the art be reluctant to consider amounts of red lead below 25% for any purpose based on the information in Davitt et al., but would find upon testing such amounts (certainly those below 15%) that an effect of red lead on the burn rate is indeed lacking. A skilled artisan looking to increase burn rates, but proportionately less than those disclosed in Davitt et al., would therefore find no advantage in using such small amounts. Consequently, it is only after realizing that such small amounts increase the ignition and propagation reliability of such compositions in rigid metal elements (which is not disclosed in the prior art), that there is any incentive in using such compositions containing small amounts of red lead.

It is realized of course that the basis of the Examiner's rejection is a combination of Davitt et al. and Taylor et al. (cited to show the use of carboxymethyl cellulose as a binder in delay compositions). While the broadest claims of the present application do not require the presence of a binder, an earlier official action required election of species which confined the Examiner's search and examination to species containing such a binder. Even assuming for the sake of argument that the Examiner's combination of Davitt et al. and Taylor et al. is correct (which is in fact denied – see below), i.e. that it would be obvious to use the binder of Taylor et al. in a composition as disclosed by Davitt et al., this would still not form the basis of a proper rejection of the claims of the present application because Davitt et al. is deficient as a reference forming a part of the combination relied on by the Examiner for the reasons given above.

It is also believed that it would not be obvious to combine the teachings of Davitt et al. and Taylor et al. Taylor et al. relates to the manufacture of "primary explosives" (col. 1, lines 14 and 15). It is stated in col. 1, lines 35-42 that:

> *The primary explosives with which the present invention is concerned are crystalline, essentially water-insoluble compounds which may generally be prepared by precipitating the primary explosives from aqueous solution, the precipitation resulting from a double decomposition reaction between two suitable reactants in aqueous*

solution or suspension, or from the crystallization of the primary explosive from solution.

Despite the reference in col. 1, lines 18 and 19 to "delay purposes", these substances are clearly not the delay compositions to which Davitt et al. and the present invention relate (compositions that burn away rapidly, but not instantly – see page 1, paragraph [0002] of the present application). Consequently, Taylor et al. is not concerned with the same type of compositions as those of Davitt et al., so there would be no motivation or suggestion to combine these references and no certainty of a useful result from doing so. Taylor et al. warns that the proportion of carboxymethyl cellulose used, as well as other process conditions, all influence the properties of the final product (col. 3, lines 50 to 57), and that "the addition of carboxymethyl cellulose gives very effective control of the rate of burning by regulating the crystal growth as well as the inertness of the explosive" (col. 3, lines 63 to 67). Given that Taylor et al. is talking about rates of burning effective for primary explosives, it is unlikely that a skilled artisan would consider such a material effective for use in delay compositions requiring very different rates of burning. It might seem to the skilled artisan that the carboxymethyl cellulose of Taylor et al. would turn the delay composition of Davitt et al. into a primary explosive, and as such should be avoided. Consequenly, it does not seem reasonable to combine the teachings of Taylor et al. and Davitt et al.

For these reasons, reconsideration and withdrawal of the rejection of claims 1 to 11 are requested.

Final Action

Since the Examiner's Action is contradictory as to whether is has been made final or not (see Office Action Summary page and page 4), it is requested that the action be treated as non-Final.

Respectfully submitted,

Edwin J. Gale
Reg. No. 28,584
Tel (613) 237-6900
Our File No. 45888-1
February 8, 2007